A "System of Systems" Approach to Regional Workforce Development

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Background: The mission of the U.S. Department of Energy's Office of Environmental Management, Los Alamos Field Office is to "cleanup of legacy contamination and waste resulting from nuclear weapons development and government-sponsored nuclear research at the Los Alamos National Laboratory." Newport News Nuclear BWXT Los Alamos (N3B), a limited liability company owned by Huntington Ingalls Industries and BWX Technologies manages the 10-year, $1.38 billion Los Alamos Legacy Cleanup Contract (LLCC) in support of this mission.

To tailor requirements to mission risks and ensure overall mission readiness, N3B must first address attrition levels that may occur in the Northern New Mexico region over the next four to seven years caused in part by unique regional demographics and the following complex-wide human capital issues facing DOE's national federal and contractor workforce:

- Workforce Maturity: A 2017 NNSA report indicates that over 50% of the workforce in key technician positions is within 5 years of retirement age & less than 7% are under 30 years old.
- Skill Gaps in Technical and Institutional Knowledge: Few employees have the minimum skills required to effectively perform the challenges encountered in working in DOE's one-of-a-kind facilities, with unique processes that may involve hazardous materials and special machinery and tools that are too often inaccessible for support from commercial industry experts.
- Unskilled Workforce Pool: "Pipelines for key technician positions at DOE sites are weak or non-existent causing significant shortages of qualified applicants as we look to the future."

Case Study - Northern New Mexico's "System of Systems" Approach: This presents a case study analysis of how N3B continues to use Systems Engineering principles and a "System of Systems" (SOS) approach to build a workforce that is resilient and has the skills and experience required to accomplish EM-LA and DOE's highly technical mission through:

- Channeling industry expertise and experience to convene partnerships with regional governments, colleges, schools, labor, workforce agencies, community organizations, and other community stakeholders.
- Pooling the capital, resources and capabilities of federal and regional systems (and sub-systems) to create a new, more complex system offering more functionality and performance than simply the sum of the constituent systems.
- Accommodating the needs of industry and community stakeholders within the constructs of larger corporate, regional and national workforce development systems and priorities.

The resulting "system of systems" successfully developed apprenticeship and mentorship programs that provide formal worker training needed to support on-going & anticipated LLCC work through instruction and experience - both theoretical and practical:

- Ensuring scarce private and public resources are not spent on inefficient infrastructure solutions.
- Creating a cost-effective, systematic and repeatable process to address its workforce needs and attrition levels in the Northern New Mexico region over the next four to seven years.

This case study demonstrates by utilizing a "system of systems" approach to create a single, unifying framework utilizing regional system and sub-system architectures industry partners can identify a supporting set of standards, interfaces, best practices, and design guides that are tailorable to address specific workforce needs in
any region.

**Keywords:**

Workforce Development, Systems Approach, System of Systems, Northern New Mexico, Apprenticeship, Regional, Department of Energy

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